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ISTHMIAN CANAL TRAFFIC.

THE Isthmian Canal Commission had an extended economic and statistical investigation made for the purpose of measuring with all possible accuracy the tonnage of ocean shipping and commerce that would use the proposed waterway. The latest available American and European statistics of commodity imports and exports and of vessel entrances and clearances were critically examined to determine the commerce that would have been served by the canal, had the proposed route then been open. This indicated the traffic available in 1899. That having been ascertained, an estimate was made of the tonnage that will be available for the canal in 1914, by which time it was assumed the waterway will have been opened.

The purpose of this paper is not so much to state the results of the Commission's investigation as to explain the methods by which the results were reached. The

investigation required an extensive use of official statistics, and it is possible that a description of the difficulties encountered in the investigation may throw some light upon the character of commercial statistics. A statement of the methods employed will enable economists to pass judgment on the accuracy of the results.

There were two distinct statistical investigations made by the Commission: One consisted of an examination of statistics of the imports and exports of the United States and of several European countries to determine how many tons of *cargo* or how much freight the trade of those countries might have contributed to the traffic through an American interoceanic canal in 1899. The other inquiry was to ascertain the tonnage of the *vessels* that would have passed through the waterway. In this latter study the data used were the statistics kept by the leading commercial nations of the entrances and clearances of the vessels engaged in the commerce between ports so situated that their maritime trade might have advantageously used the canal. It was fortunately possible to compare the results of these two investigations not only with each other, but also with the results of a third and very different study made by the New Panama Canal Company, which from 1894 on had kept a record of the actual movements of ocean vessels.

Inasmuch as the use made of the canal will be affected by the tolls charged, it was necessary to have the influence of tolls in mind in studying the tonnage of available traffic. The plan followed was to consider the effects which a toll of one dollar per vessel ton, *net* register, would have in diverting possible traffic. This toll is only half that charged by the Suez Canal Company, but the United States government will hardly be disposed to levy a toll of more than a dollar per ton net register. Indeed, the

charge will probably be less. However that may be, a toll of a dollar a ton net register would prevent but little commerce from using the canal, while a toll that much exceeded a dollar would probably considerably restrict the tonnage. This conclusion was reached as the result of a study of the distance and time that would be saved by the commerce of all the countries so situated that their use of the canal, instead of existing routes, would depend on the tolls. The economy in distance and time for each doubtful route through the canal was converted into the saving in the expense of operating vessels and this sum was compared with the amount of toll which the vessels would have to pay for using the canal.

CARGO TONNAGE OF TRAFFIC AVAILABLE IN 1899.

The statistics of the internal commerce of the United States and of other countries give the volume of business in tons. The traffic of the railways, rivers, and canals, and the productions of our mines and furnaces are measured by the ton unit; and the same is true of the products of our farms and forests when in the possession of the transportation agent. The statistical units of weight most familiar to the people of the United States are the short ton of 2,000 pounds and the "long" ton of 2,240. The long ton is not employed so much in this country as it formerly was; but in the United Kingdom the ton of 2,240 pounds is still more generally used than the short ton. In countries that have adopted the metric system of weights and measures the ton weighs 2,204 pounds.

In the government statistics of ocean commerce no record is made of the cargo or weight tonnage of the commodities carried, and the volume of business done is expressed in terms of vessel tonnage. The "gross register

tonnage" of a ship is the capacity of its hull in cubic feet divided by 100, and its "net register tonnage" is determined by dividing by 100 the cubic feet of space available in the vessel for cargo. Maritime commercial statistics are usually given in net register tonnage. To those who are directly concerned with maritime commerce the statistics of vessel tonnage are a readily understood index of the volume of commodity traffic; but to many, if not most men engaged in industrial pursuits, the cargo ton of 2,000 or 2,240 pounds is the customary unit employed in measuring the volume of trade, and the figures of net tonnage have little significance until they have been converted into tons of weight.

The business world being accustomed to consider the amount of traffic in terms of the cargo ton, a statement in that unit of the volume of available canal traffic conveys definite information readily comprehended without being translated. The statistics of the cargo tonnage of ocean commerce permit comparisons to be made with the statistics of internal traffic, while statements of vessel tonnage do not. The saving in freight rates, furthermore, that the opening of an Isthmian Canal would make possible can be more intelligently considered by knowing the volume of cargo freight that would use the waterway. Ocean rates, like railway freight charges, are levied on the cargo ton of weight or measurement; but, unlike the statistics of railway traffic, those of maritime commerce give no data regarding freight tonnage.

The United States Bureau of Statistics collects the statistics of our foreign trade, and in its monthly and annual publications gives the value of imports and exports by classes of commodities and by ports. Tables are also published giving the values, and, in many cases, the quantities of the commodities exported from each

port to foreign countries as a whole. Similarly, the values and usually the quantities of the imports entering our several ports from foreign countries taken collectively are given. Though these tables are elaborate and of great value, they do not give the amount of trade by articles and quantities carried on between our several ports and the countries with which we exchange commodities. It is not possible to obtain the actual cargo tonnage of the total foreign trade of the United States directly from our official statistics, because the published tables seldom give the weights of the commodities, frequently do not state the quantities, and in no instance is the ocean freight tonnage stated. This is equally true of the commercial statistics compiled by foreign countries.

It is likewise impossible to ascertain from the published tables the kinds and quantities of commodities that constitute the trade carried on through and by our several ports with different countries. Our published statistics indicate the foreign trade carried on at each port of the United States; and the distribution of our entire trade among the several countries is shown, but it is in the form of total values. The Bureau of Statistics possesses the data necessary for this analytical presentation, by articles, of the trade of our respective ports with each foreign country; but the tables which such a presentation would require would be so voluminous as to make their publication for all ports impracticable. A table would need to be constructed for each port or customs district, showing its trade with each foreign country in each article or class of articles imported and exported. There are at the present time more than 50 maritime customs districts trading more or less with 92 foreign countries by exchanging some or all of the 661 articles in the classified list of the commodities.

Not being able to obtain from the published tables the data necessary for the calculation of the cargo tonnage of our ocean commerce that would now make use of an Isthmian waterway, resort was had to the unpublished folios, access to which was courteously given by the United States Bureau of Statistics. The facts concerning the trade of each port were copied from these folios, and two sets of tables were constructed, one for the Pacific ports of the United States and one for the Atlantic. The tables constructed for the Pacific ports showed for each port the values, and, when obtainable, the quantities of each class of articles imported and exported in the trade carried on with each foreign country on the Atlantic. Similar tables were made giving the trade of each Atlantic port with each Pacific country. Having secured the mass of data contained in these compilations, the work of converting quantities and values of commodities into their cargo tonnage equivalents was begun, and the results of the calculations were four comparatively small tables giving the values and the cargo tonnage of the imports and exports composing the trade which our Pacific ports had with the Atlantic countries in 1898-99, and which our Atlantic ports had with Pacific countries the same year. The four tables showed respectively (1) the value and cargo tonnage of the imports into each of our Atlantic ports from the Pacific foreign countries traded with; (2) the exports from each Atlantic port to those countries; (3) the value and cargo tonnage of the imports into each Pacific port from each Atlantic foreign country dealt with; and (4) the value and cargo tonnage of the exports from each of our Pacific ports to each Atlantic country to which commodities were sent. These tables are too large and detailed to be conveniently reproduced here, but they can be summarized as follows:—

VALUE AND CARGO TONNAGE OF THE TRADE WHICH THE UNITED STATES WOULD HAVE HAD THROUGH AN ISTHMIAN CANAL DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

	Pacific Coast.		Atlantic Coast other than with Hongkong and Philippines	
	Values.	Cargo Tons.	Values.	Cargo Tons.
Imports . .	\$5,435,003	300,829 8	\$33,751,161	534,371 6
Exports . .	18,352,450	715,682.9	40,210,860	1,020,514 9
Total . .	\$23,787,453	1,016,512 7	\$73,962,021	1,555,886.5

	Atlantic Coast with Hongkong and Philippines.		Total Atlantic.	
	Values	Cargo Tons.	Values.	Cargo Tons.
Imports . .	\$6,059,678	99,200.9	\$39,810,839	633,572.5
Exports . .	1,959,975	151,540 2	42,170,835	1,172,055.1
Total . .	\$8,019,653	250,741.1	\$81,981,674	1,805,627 6

Grand total: values, \$105,769,127; tons, 2,828,013.3 (including 873 tons miscellaneous exports of foreign exports).

In constructing the tables, the trans-Atlantic trade of our Gulf and Atlantic ports was omitted because it would not be tributary to the canal; and the figures include only the ocean foreign commerce now carried on by our Atlantic and Gulf ports with Pacific countries, and between our Pacific ports and countries on the Atlantic. In the case of each port named, only that part of its foreign trade was taken that might be directly affected by the opening of the canal.

According to the classification of the United States Bureau of Statistics the imports number 333 classes and the exports 328. For each item in this list of 661 com-

modities the value was obtainable. For some of the classes the number or quantities of articles were reported; and, for many commodities, weights were given in the official statistics. In all cases, however, the weights given were net, covering only the commodity and not the packing or "tare" which constitutes a part of the freight cargoes whose weights were to be ascertained. In order to determine the weight of the tare corresponding to the weight or value of the ordinary unit of each of the many commodities considered, a large amount of detailed information had to be secured from business men concerning the manner of shipping the various articles. The difficulties of this and other parts of the investigations were somewhat complicated by the fact that many commodities of bulky character are handled by ocean vessels as measurement cargo, 40 cubic feet being reckoned as a ton instead of 2,240 pounds, the weight ton commonly employed in maritime traffic. In determining the true cargo tonnage of goods shipped by the measurement ton, it was necessary to ascertain the cubic contents, boxing included, of some unit of quantity.

To reduce commodity values to weights, to find the average tare for net weights, to learn whether shipments were made by weight or measure, and, if by measure, to find the weight or value of a measurement ton, an extensive correspondence was carried on with men engaged in foreign trade. Representative business men of the leading commercial cities were requested to give the assistance needed; and by means of personal interviews and a large correspondence a mass of information was secured, covering the great bulk of both our import and export trade. In order to insure the greatest possible accuracy for the tables of cargo tonnage, inquiries regarding each line of foreign trade were made of representative

firms of several of the large seaports, and in some instances several firms were corresponded with concerning each commodity about which information was required. This correspondence extended over several months, and required the sending out of several thousand individual letters; but by means of the knowledge obtained from the business men, who generously gave the time required to reply to the requests for information, it was possible to prepare the tables by converting, item by item, into equivalent cargo tons, the values of nearly all of the articles that our various ports would have imported and exported by way of an Isthmian Canal during the fiscal year ending June 30, 1899. Although it was not possible to get the requisite data for converting every item, however, there are but 5.7 per cent. of the imports and 0.4 per cent. of exports included in the above table that were not converted according to the method just described. The small quantity of imports and exports for which it was not possible to secure satisfactory factors to use in changing values of cargo tons were converted by using for a multiplier a ratio of values to tons, chosen separately for each coast of the United States and also separately for the imports and exports, with reference in each instance to the nature of the commodities being considered.

The total value of the maritime commerce of the United States that might have used an Isthmian Canal to advantage during the fiscal year ending June 30, 1899, was \$105,769,127. Of this total trade the Pacific ports had \$23,787,453 worth, and the Atlantic, including their trade with the Philippines and Hongkong, \$81,981,674 worth. Whether all the trade carried on between our Eastern ports and the Philippines and Hongkong may properly be included in this total value of the commerce of the United States available for canal traffic is an important

question that is considered in the discussion which follows regarding the entrances and clearances of the vessels that would have used a canal during the past year. In this connection it is sufficient to note that the value of the trade of the Atlantic Coast ports of the United States with Hongkong and the Philippines has been stated separately.

The value of the exports from our west coast to Europe in 1899, \$18,352,450, and the corresponding cargo tonnage, 715,682.9 tons, were abnormally small because of the severe drought of the year 1897-98. The larger part of tonnage export of that section consists of grain, and during the year 1898-99 the grain exports were less than 50 per cent. of their average for the five years preceding. If the value of the grain exports of the Pacific Coast for the fiscal year 1898 be substituted for those of 1899 in the above table, the total value of the west coast exports would have equalled \$40,299,881. The exports other than grain had practically the same value in 1898 and in 1899. Had the grain exports of 1899 been equal to those of 1898, or, in other words, had their amount been normal, the cargo tonnage of the west coast exports would have been 1,328,757 tons instead of 715,682.9 tons, the figures in the above table; and the total cargo tonnage, instead of having been 2,823,013.3 tons, as stated in the table, would have been 612,874.1 tons more, or 3,435,887.4. This larger total is a much more accurate expression than is the smaller total of the cargo tonnage of our maritime foreign commerce available for canal traffic during the year under consideration. This larger sum will be used in the comparison that will subsequently be made with the tonnage estimates derived by other methods of investigations that will be described later.

Up to this point only the cargo tonnage of the commerce of the United States has been considered. The large mass

of information which the investigation of American trade had furnished regarding the relation of values and quantities to cargo tonnage was equally applicable to the commerce of foreign countries; and this information enabled the conversion of the greater part of the trade of other countries to be made easily and quickly. The commodities not changed from values to tons by the direct method were converted by means of averages chosen by a method similar to that used in the conversion of American imports and exports.

It was not considered necessary to determine the cargo tonnage which every foreign country now has available for canal traffic. By taking the nine European countries,—the United Kingdom, France, Germany, Belgium, Holland, Austro-Hungary, Italy, Spain, and Sweden,—nearly all the commerce which foreign nations would have with the west coast of America and Hawaii was reached. Norway had no commerce with this section, and that of Greece and Russia was slight. The trade of Europe with our west coast was included in the study of our canal commerce. The detailed table of the trade with the west side of South and Central America may be summarized, as follows:—

SUMMARY OF CARGO TONNAGE OF EUROPEAN IMPORTS AND EXPORTS.
TRADE WITH SOUTH AND CENTRAL AMERICA, BEGINNING OF 1899.

	South America.	Central America.	Totals.
Imports	2,041,147	75,320	2,116,467
Exports	999,805	54,556	1,054,361
Totals	3,040,952	129,876	3,170,828
Grand total			

Whether the entire commerce of Europe with the west coast of South America would make use of the Isthmian Canal will depend somewhat on the canal tolls. In general, the canal will secure nearly all of this trade unless the tolls should be so high as to make the longer and less desirable route around the Horn or through the Straits of Magellan more profitable. The only trade that would not pay a moderate toll of a dollar a ton net register for the privilege of using the canal is that of Chile south of the 40th parallel of latitude; and the commerce of that section is not, and can hardly become, of much consequence.

It will be seen that nearly two-thirds of the entire cargo tonnage of the trade between the nine European countries and the west coast of Spanish America consisted of imports from South America. Four-fifths of these imports were from Chile. This indicates the present prominence of the nitrate of soda trade. In cargo tonnage, Germany ranks first among the nine nations in the trade with the west coast of Spanish America; but in value of commerce the United Kingdom is much ahead of Germany because of the high value of the British exports. Germany's large import tonnage is made up mostly of nitrate of soda for use in her chemical industries, and her exports contain some coal, but consist largely of manufactures. The coal exports of the United Kingdom are heavy, but the exports as a whole derive their value mainly from the manufactures.

The cargo or freight tonnage of Europe's trade with Hawaii and British Columbia in the fiscal year 1899 is shown in the table on the opposite page.

In this table the figures are based upon statistics kept by Hawaii and British Columbia. The vessels entering Hawaii take cargoes mainly of sugar to the United States,

CARGO TONNAGE.

EUROPEAN TRADE WITH HAWAII AND BRITISH COLUMBIA.

	Hawaii.	British Columbia.	Totals.
Imports	33,793	37,334	71,127
Exports		24,699	24,699
Totals	33,793	62,033	95,826

hence there are no exports from Hawaii given in the table. The British Columbia trade during the year ending June 30, 1899, was but little more than two-fifths that of the previous year, and for that reason the totals of the above table are unduly small; but, for the sake of presenting the latest data, it was thought best to retain the figures for the year 1899.

The cargo tonnage of the European trade with the west coast of Mexico is not obtainable because the European statistics do not separate the commerce with the east coast of Mexico from that with the west coast.

The total freight tonnage of the trade between European countries and Western South and Central America, British Columbia, and Hawaii during the latest statistical year for which information was obtainable was 3,266,654 tons. This total does not comprise the commerce with the west coast of Mexico. Moreover, it does not include any of the commerce between Europe and Eastern countries, a part of which would pass through the American Canal. In studying the tonnage of cargo that the commerce of the United States might have furnished the canal in 1898 and 1899, the total was found to be 3,435,887 tons. The sum of these two totals is 6,702,541. These are figures applying to the commerce of the past, carried under the conditions then prevailing. They do not refer to the future.

TONNAGE OF THE VESSELS THAT WOULD HAVE USED AN
ISTHMIAN CANAL IN 1899.

Inasmuch as all important commercial nations record the entrances and clearances of the vessels trafficking at their ports, and state with which countries the vessels trade, it is theoretically a simple matter to determine the tonnage of the vessels at present following routes for which the canal route would be substituted. As a matter of fact, however, the statistics of entrances and clearances have certain important limitations due to the fact that different countries follow dissimilar rules in making their statistical records. In some cases also the records are incomplete, as, for instance, the figures recording the tonnage of vessels trading between Europe, Mexico, and Central America do not indicate whether the European entrances from those countries are from the Atlantic or from the Pacific Coast. The same limitation exists as to European clearances to that section of the world.

The lack of uniformity of methods of collecting statistics of entrances and clearances may either result in a duplication of tonnage records or in an understatement of the tonnage engaged in the commerce of certain countries, and it is unfortunate that the statistics of international trade are not compiled in accordance with uniform rules. A vessel entering a German port is recorded as coming from the country that supplied the vessel with the largest share of its cargo. If this vessel were to enter a British port, she would be recorded as having sailed from the most distant country from which cargo was brought. The French practice is the same as the English. In compiling the statistics of clearances, it is the practice of Great Britain to record a vessel as clearing for the most distant country for which she has cargo. The German figures

credit the clearances to the country to which the most cargo is bound. The French practice is like the English.

Correspondence with the collectors at a number of the ports of the United States revealed the surprising fact that our statistics of entrances and clearances were compiled by various methods at different ports. The New York statistics recorded a vessel as clearing for the first or nearest country to which cargo was taken. The vessel was entered from the most distant country. At other ports, however, different practices prevailed, four variations in methods having been reported by our collectors of customs.

Although the American statistics of entrances and clearances are not compiled in accordance with uniform rules, there are probably no duplications in the figures. In fact, the practice of New York, from which the major share of our commerce moves, of recording a vessel as clearing for the first port of call for the discharge of cargo, is apt to lead to understatement rather than an exaggeration of the volume of outbound traffic destined for countries that will be reached by way of an Isthmian Canal. In the case of European statistics the following duplications are possible: (1) German vessels outbound may call at Holland or Belgium and be recorded there. These German vessels outbound might possibly, though as a matter of fact they seldom, if ever do, call *en route* at British ports. One German line calls at a French port. (2) German vessels inbound may call at a French, Belgian, or Dutch port; but, as a matter of fact, they do not call at Belgian or Dutch ports. Most of the trade from the west coast of South America to Europe is carried in full cargoes, and German vessels are not apt to make calls *en route* at European ports. This is indicated by the fact that the Belgian clearances in the South American trade

consist almost entirely of steam tonnage, while the entrances are made up mostly of sailing vessels. The same is true of the Netherlands. In regard to the French statistics there is some uncertainty. (3) Two British lines to and from the west coast of South America call at French ports. Thus the French statistics are liable to include some tonnage entered in the British and some contained in the German figures. (4) In the case of Spanish statistics of entrances and clearances it is possible that some British, some French, and some Italian tonnage may be included.

It is only in the statistics of the European trade with the west coast of South America that the duplications which concern us are possible. The following table summarizes the apparent vessel tonnage of the trade of European countries with Western South America. It was compiled from the latest figures then available, which in the case of the United Kingdom, France, Belgium, the Netherlands, and Italy were for the calendar year 1899, and for the other countries were for 1898.

EUROPEAN ENTRANCES AND CLEARANCES.
VESSELS TRADING WITH WEST COAST OF SOUTH AMERICA.

	Entrances.	Clearances.	Total Entrances and Clearances.
United Kingdom	297,752	452,632	750,384
Belgium	110,750	103,577	214,327
Netherlands	59,947	3,348	63,295
German Empire	256,870	141,452	398,447
Italy	13,218	10,180	23,398
Spain	77,156	139,599	216,755
France	325,358	153,251	478,609
Sweden	2,272	472	2,744
Total	1,143,323	1,004,636	2,147,959

The trade of Europe with Western South America apparently comprises a total of 2,147,959 tons. In order to determine more nearly what the actual vessel movement was, it was necessary to eliminate duplications as far as it was possible to do so. Efforts were made to secure information from the statistical departments of European governments, not only regarding the regulations which they follow in the compilation of their statistics, but also concerning the movements of vessels. The information obtained, however, was not sufficient to make possible the avoidance of a resort to estimates in making reductions from the statistical table above given.

Great Britain and Germany are so situated that they are the European termini of vessel movements between Europe and South America. Accordingly, the German and British figures for entrances and clearances may well be taken without alteration. Such, however, is not the case with Belgium, the Netherlands, France, and Spain, at whose ports both German and British vessels call *en route*. At Spanish ports, French and Italian vessels, as well as British, make more or less frequent calls. An examination of the Dutch and Belgian entrances and clearances shows that the vessels arriving consist of sailing vessels, and that those departing are nearly all steamers. This would indicate that the incoming traffic is carried by chartered sailing vessels with full cargoes. These sailing vessels, after discharging their cargo, doubtless depart for a British port in search of outbound coal cargoes. The steamers clearing from the Belgian and Dutch ports are in all probability mostly German vessels, although some British tonnage may be represented. In view of these facts it seems that the Belgian and Dutch figures for entrances should be retained in the total without alteration, but that some reduction should be made in the clear-

ances to avoid recording a vessel a second time whose tonnage has already been included in German clearances. The total clearances from Belgium and the Netherlands are 106,995 tons; but these clearances cannot all have been entered in the German figures, because the German clearances are much less than the entrances. It seems probable that the larger part of the tonnage of German vessels recorded as clearing for South America goes in ballast to Antwerp, and is not recorded in the German clearances. Just how much reduction should be made in the clearances of Belgium and the Netherlands must be entirely a matter of judgment. It was thought proper to take 30,000 tons from the total.

The largest amount of duplication in the tonnage figures doubtless occurs in the French statistics. There is one French line of steamers plying between France and the western coast of South America. English vessels call at French ports, and at least one German line makes calls *en route* at two French ports. The French entrances are 172,107 tons greater than the clearances, and it is probable that this excess of entrances over clearances is to be accounted for by the tonnage of chartered sailing vessels which bring full cargoes—mainly nitrate of soda—to France. This difference, then, ought to be included in the French figures. Furthermore, the figures which cover the entrances and clearances of the French line ought to be included. Probably 50,000 tons of entrances and a like amount of clearances will cover the vessel movements of that line of steamers. It is probable that the remainder of the total entrances and clearances, as shown in the French figures, is also comprised in the British and German statistics. It has therefore been thought proper to deduct from the French figures, as shown in the table, 206,502 tons; that is, the difference between 272,107 (the sum included) and 478,609, the total shown in the table.

Both British and French vessels call at Spanish ports, and probably Italian vessels occasionally do. The amount of commerce which Spain has with the west coast of South America is not much; and probably the figures for the entrances, 77,156 tons, cover all the commerce which that country has with the American section under consideration. The clearances are very much larger than the entrances, but the amount of outbound commerce is slight. It seems certain that the Spanish figures for clearances represent English and French vessels that have already been recorded in clearance statistics before reaching Spanish ports. Accordingly, it is believed that accuracy demands the subtraction of the Spanish clearances from the totals of the above table. The entrances and clearances of Italy are small, and doubtless represent the actual vessel movement between Italy and Western South America. The same may be said of Sweden. Russia does not appear in the table, because there were no vessel movements between her ports and Western South America during the year under consideration.

The reductions which the foregoing analysis suggests ought to be made amount to 376,101 tons, which, taken from 2,147,959 tons, the total of the table, makes the revised total 1,771,858 tons. The absolute accuracy of this corrected total cannot be asserted. At best it is only approximately accurate, and must be so regarded. It may possibly be as much as one hundred thousand tons in error, although that is hardly probable. There were various ways of checking these figures so as to determine whether they are approximately correct or whether they are largely in error. One general method was to compare the totals reached by the three separate statistical investigations. A study was made of the importation of nitrate of soda into European countries, the most important export

from Western South America; and the tonnage of British coal exports was also considered. The figures of nitrate and coal movements are in general accord with the distribution of vessel tonnage suggested in the above revision of the totals of the tables of entrances and clearances. Furthermore, the information that was obtained regarding the routes of steamers owned by European countries operating vessels in the South American trade supplemented the data supplied by foreign governments in such a way as to make it probable that the revised total of 1,771,858 tons fairly approximated the facts.

It is impossible to determine the amount of the trade and shipping passing around the Horn or through the Straits of Magellan between Europe and the west coast of *Central America and Mexico*, because Mexico and all the Central American countries except Salvador have ports on both oceans, and Germany and Italy are the only European countries whose statistics designate to which coast of these countries the published figures apply. The entrances and clearances for Salvador's trade with Europe and for the German and Italian trade with the west coast of Central America and Mexico amounted to 70,367 tons. This total does not include any of the trade across the Isthmus of Panama. In view of the importance of the United Kingdom in the commerce of the world, and in consideration of the fact that the larger part of the population, industry, and trade of Central America is on the Pacific side, it was deemed proper to double the above figures and to take 140,000 tons as the estimate of the vessel movements concerned with the trade between Europe and the west coast of Central America and Mexico.

The trade between the Pacific Coast of the United States and Europe comprised 213,798 tons, net register, of entrances and 360,254 tons of clearances,—a total of 574,052

tons. A large number of vessels cleared for Panama with traffic for Europe by way of the Panama railroad, but that traffic is not being considered here. The total entrances and clearances for the trade of British Columbia with Europe in 1899 amounted to but 43,092 tons. The previous year they were 106,485 tons. There are no clearances from Hawaii to Europe recorded. The ships take Hawaiian sugar to the United States, and clear thence for Europe or elsewhere.

Vessels trading between our Atlantic Coast and the west coast of South America, Eastern Australia, Oceania, Japan, and China will use the Isthmian Canal with the possible exception of a part of the vessels passing to and from Hongkong and the Philippines. A portion and probably the larger share of the Hongkong and Philippine trade will use the canal. The total entrances and clearances between our eastern seaboard and Hawaii and the countries of Western South America for the year ending June 30, 1899, were 166,364 tons. There was no direct vessel movement during that year between our Atlantic Coast and British Columbia and Pacific Mexico or Central America.

The vessel movements between the eastern ports of the United States and trans-Pacific countries comprised a total of 454,070 tons of clearances and 173,352 tons of entrances, —a combined total of 627,422 tons. There were special difficulties encountered in securing the statistics of the vessel movements between our western seaboard and Eastern countries, because the published figures of entries and clearances do not truly record the actual movements of vessels. This is due both to our practice of recording the statistics and to the fact that vessels stop going and coming at European and other countries on their voyages between the United States and the Orient.

The above figures comprise the tonnage of vessels which the records of our customs houses show to have made a voyage from our eastern ports to countries east of Singapore or to have entered directly from those countries. As a matter of fact, many vessels take cargoes from the United States to Europe, then load for the East, whence they may return to the United States either by way of Europe or by sailing in the opposite direction. A large part of our exports to the East are sent to Europe and there reshipped. Likewise a good portion of our imports from trans-Pacific countries come to us by way of Europe. The above figures are defective for two reasons. They give no information concerning the vessel tonnage employed in carrying our exports that went to Eastern countries by way of Europe and our imports that came from those countries by some European city. Again, they understate the tonnage of the ships that come from Eastern countries to the United States. Many of the vessels come by way of Java, and are entered from the Dutch East Indies. Others come by way of Europe, and are entered as from there. Some come from Chile.

A more adequate measure of the tonnage of the shipping engaged in the commerce between our eastern seaboard and Oriental countries would be secured by doubling the tonnage of vessels making the voyage directly to those countries. This larger total, 908,140 tons, is probably too small; but it was adopted as the best figure obtainable by the study of the statistics of entrances and clearances and of facts regarding commercial movements. One reason for thinking it unduly small is that the vessel tonnage of the commerce between our Pacific Coast and the trans-Pacific countries east of Singapore in 1899 amounted to 1,591,000 tons. While the vessel tonnage of this Pacific trade was doubtless greater than the vessel tonnage of the

American Atlantic trade with the countries east of Singapore, it does not seem probable that the latter tonnage was less than three-fifths of the former. Another reason for thinking that the vessel tonnage engaged in the commerce between our eastern seaboard and Eastern countries was fully as much as, if not more than, 908,140 tons during the fiscal year 1899, is that the Panama Canal Company's record of vessel movements between the American Atlantic seaboard and the Pacific section east of 90° east of Paris makes the total tonnage for the calendar year 1,271,357 tons. This total includes Singapore, Sumatra, and Java, and, should be larger than the total of 908,140 tons, but probably less than 363,000 tons larger.

From New York and the North Atlantic ports of the United States the distance to the Philippines and Hongkong by the American canal route will not be very much less than by Suez. Consequently, the trade of our eastern seaboard with those and other places so nearly antipodal will be divided between the easterly and westerly routes. The shipper will have the advantage of the competition of the carriers using the different canals. The coast between Shanghai and possibly Yokohama on the east, and Singapore and possibly India on the west, will be traversed in both directions by vessels bound for American ports.

The overlapping of trade routes in the East, and the tendency of vessels to follow the routes where the greatest volume of traffic can be secured, may possibly bring some of the East Indian trade across the Pacific and through the American canal. One of the advantages of the route by the American isthmus will be cheaper coal; and another inducement to vessel owners will be the shorter trip in tropical latitudes, where many commodities are liable to be injured by heat and humidity. Although a part of the Hongkong and Philippine trade with our At-

lantic seaboard will unquestionably make use of the Suez route, the figures have been allowed to stand without reduction, because the statistics of entrances and clearances collected at our Atlantic and Gulf ports do not include all of the present commerce of the eastern half of the United States with trans-Pacific countries that might use the American canal, were it available.

In considering the vessel tonnage of the existing commerce that might use an Isthmian Canal, some account should be taken of the shipping that now plies between Asiatic countries and our Pacific Coast. With China, Japan, and Siberia this amounts to 333,689 tons. With Hongkong and the Philippines the tonnage is 464,978, and for both sections combined 798,667 tons. A large but indeterminate part of this trade between the Pacific Coast and trans-Pacific countries originates and ends east of the Rocky Mountains. Doubtless the greater share of this trade will always go overland to and from the Pacific Coast, but some considerable portion will be diverted to the Isthmian route after the canal has been opened. If this diverted trade and tonnage should amount to but 20 per cent. of the total, it would equal about 160,000 tons, —a tonnage equal nearly to our Atlantic Coast vessel movement to and from Hongkong and the Philippines in 1899.

While the Suez Canal will get some of the commerce of eastern Asia and the Philippines with our Atlantic seaboard after the Isthmian Canal has been opened, it is believed that this traffic through the Suez may be offset by the amount of the vessel tonnage of our present Pacific Coast import and export trade that would use an American canal. Furthermore, while the Suez route will draw from Manila and points north and east, the Isthmian route will also secure tonnage from the territory lying south and west of Manila. It is thought that these facts warrant

the inclusion of all the Atlantic Coast tonnage to and from China, Japan, Hongkong, and the Philippines in the estimate of the vessel tonnage that would find the use of the canal advantageous. Such an estimate as this can be only approximately accurate, because it is impossible to predict closely the routes which the East Indian and South Asiatic trade will actually follow after the American interoceanic canal shall have completed the water route around the world.

The foregoing discussion has made no reference to the effect which the canal will have in diverting from its present rail and water routes a portion of the commerce now carried on, by way of our Pacific Coast ports, between the eastern half of the United States and Australia, Hawaii, and the rest of Oceania. There are excellent steamship connections between the west coast of the United States and Canada, Hawaii, and Australia; and the traffic and travel of the Eastern United States to and from those countries is in part conducted through Pacific Coast gateways. The Isthmian Canal and the steamship connections by way of it will undoubtedly affect the present routes for some of the traffic now carried on between our Eastern States and those countries. The entrances and clearances of the vessels trafficking between our Pacific Coast and Australia, Hawaii, and other islands of Oceania amounted to 711,643 tons during the fiscal year 1899; but none of this tonnage is included in the figures here given for the canal traffic.

The present trans-Isthmian traffic is a part of the Atlantic-Pacific trade of both Europe and America. Several lines of steamers run north from Panama on the west coast, two lines run south, and the business of those steamers would become canal traffic. More than a million tons of shipping enter the port of Colon each year, but that tonnage would not be a fair index of the amount that

would go through the canal. Colon is a port of call for nearly all the lines of steamships connecting the Gulf, West Indian, and Caribbean waters with the United States and with all the leading European countries. A call at Colon is but an incident in the voyage of the steamers trafficking in the Gulf and Caribbean, but the situation at Panama is different. The geographical location of that city is such that a large part of the steamers from the north or south make Panama the beginning or end of their voyages. Before the year 1899 the lines from the south did not go north of Panama, and none from the north went south of Panama. Since then the lines from the south have extended their route beyond Panama, and that city has now become a port of call as well as a terminal point. If, however, the year 1898 be taken, the tonnage of Panama may be considered as indicative of the tonnage which the trans-Isthmian trade of that time would have caused to use the canal.

During the year 1898, 149 steamers, with an aggregate tonnage of 336,998 tons, entered this port. Whether both the entrances and clearances at Panama should be included in computing the canal tonnage which the commerce at Panama would have contributed to the traffic of an Isthmian waterway in 1898, or whether only the entrances should be counted, constitutes an interesting question in statistics. The clearances were practically identical with the entrances; and, if they were included, the above total would be doubled. But, inasmuch as the total tonnage of cargo freight, northbound and southbound, handled by the Panama railroad in 1898 was only 268,156 tons, it was thought best to count only the entrances at Panama, 336,998 tons, in arriving at the total available canal traffic.

The coasting trade between the two seaboard of the United States carried on by way of Cape Horn or the Straits of Magellan is the only additional tonnage item

requiring examination. The Horn route has been followed since the days of '49; and, while it will probably be deserted after the completion of the canal, it or the Straits of Magellan will be increasingly used until that time. Until 1898 this traffic was handled mainly by sailing vessels, but the line of seven new steamers recently installed in this trade will largely displace the sailing vessels that have had a practical monopoly of the traffic for a half-century. Owing to the large annual fluctuations to which this trade has been subject, an average of Pacific entrances from Atlantic ports and Atlantic entrances from Pacific ports during the past ten years was taken. These averages combined give a total of 109,312 tons per year. The Atlantic entrances averaged 26,323, and those of the Pacific 82,989, showing that Europe is the selling market of the Pacific States, and our Atlantic States are the buying market. Two-thirds of the vessels sailing to our west coast from our Atlantic seaboard clear from our west coast to Europe, cross thence to our Atlantic ports to load for the Pacific slope.

The entrance and clearance totals for the various categories of commerce studied in the preceding pages are summarized in the following table:—

SUMMARY OF ENTRANCES AND CLEARANCES, COMMERCE OF EUROPE
WITH PACIFIC AMERICA AND COMMERCE OF EASTERN SEABOARD
OF THE UNITED STATES WITH PACIFIC COUNTRIES, 1899.

Europe with	
Western South America	1,771,858
Western Central America and Mexico	140,000
Pacific Coast of United States, British Columbia, and Hawai	642,180
Eastern Seaboard of United States with	
Western South America and Hawai	166,364
Pacific Coast of the United States	109,312
Trans-Pacific Countries	908,140
Panama Traffic (1898)	336,998
Total	<u>4,074,852</u>

The total of the above summary, 4,074,852 tons net register, comprises the vessel tonnage of the trade of Europe with Pacific America and of our Atlantic seaboard with Pacific countries. Every possible effort was made to analyze, verify, and correct the statistical data consulted. It was thought better to err, if at all, on the side of understatement.

Attention was called above to the abnormally small export of grain from our Pacific Coast during the year 1899. If the grain exports of the normal year 1898 were substituted for those of 1899, the above vessel tonnage total would need to be increased over 400,000 tons. The grain exports of 1898 exceeded those of 1899 by 612,874 cargo tons; and this, according to the ratio of cargo tonnage to net register tonnage for the Pacific Coast exports as a whole, would be equivalent to 408,723 vessel tons.

This discussion of vessel tonnage has not considered the commerce of Europe with the western half of the Pacific Ocean, a part of which, it is believed, for reasons to be stated later, will make use of the American canal instead of the Suez or Cape of Good Hope routes. In stating the entire amount of vessel tonnage that was available for the use of the canal in 1899, some share of the European commerce now using the Suez or rounding the Cape of Good Hope should be included.

THE TRAFFIC INVESTIGATION BY THE NEW PANAMA CANAL COMPANY.

The New Panama Canal Company divided that part of the world's commerce capable of being affected by the proposed canal into the four groups that had been adopted in 1890 by the *Commission d'Études* appointed by the receiver of the *Compagnie Universelle du Canal Inter-océanique*. These four groups were: (1) the commerce

between Europe and the Pacific Coast of the American continents; (2) the commerce between Europe and the Far East,—*i.e.*, China, Japan, Australasia, and Oceania, and the French and Dutch East Indies; (3) the commerce between the Atlantic and Pacific Coasts of America; and (4) the commerce between the Atlantic coast of America and the Eastern countries included in Group 2.

Briefly stated, the plan adopted in 1894 by the New Panama Canal Company to determine what part of the world's present ocean tonnage would make use of an American interoceanic canal was to record and follow the movements of all vessels engaged in the commerce being carried on between the Atlantic and Pacific Oceans. This record of vessel movements was taken from Lloyd's two publications, the *Daily Shipping and Mercantile Gazette* and the *Weekly Shipping Index*, where the Canal Company was able to secure information concerning the arrivals, departures, and whereabouts of all ocean vessels,—about 12,500 in number, as their records subsequently showed.

During the years 1895 and 1896 the plan followed in making up the record was to go through each issue of Lloyd's daily and weekly publications, and place against each vessel, whose route was such as to bring it within one of the four groups of commerce just mentioned, a check indicating to which group the ship was to be accredited. Lists of the vessels thus checked were arranged alphabetically, showing for each of the four classes and for sailing vessels and steamers separately the facts regarding each ship that were given in Lloyd's *Gazette* and *Index*. These eight alphabetical lists—four for steamers and four for sailing vessels—were then turned over to draftsmen, who charted the movements of the vessels named in the eight lists by using sheets of paper which had the names of the ships in a column at the left, and which were divided

into perpendicular columns headed with the names of the twelve months and with the weeks of the year by number from one to fifty-two.

Experience showed that the plan of checking off and copying from Lloyd's lists the vessels according to groups was somewhat defective, because on the charts some vessels would disappear from one group and appear in another in such a way as not to indicate what the intermediate movements of the vessel had been. It also happened that some vessels disappeared from the record after they had touched at a Pacific port, and that other ships appeared on the record as clearing from a Pacific port without there being any record regarding their previous voyages. To obviate this defect, it was decided at the beginning of 1897 to discontinue checking the names of vessels in the *Gazette* and *Index* and preparing lists of the ships thus checked, and instead of doing this work to make a card catalogue (*affiches*) of every ship named in the Lloyd publications. In this catalogue each ship had its card; and on this card all desired information regarding the vessel was entered, and a record kept of the movements of the ship. The graphic charts of the voyages of the vessels were prepared from these cards.

During the year 1897 the Canal Company further improved its methods of conducting the traffic investigation. From Lloyd's *Shipping and Mercantile Gazette* tables were prepared showing for each Pacific port, separately for steamers and sailing vessels and classified according to the four groups of commerce, the name, flag, tonnage, etc., of all the vessels entered and cleared. These tables gave full information regarding the steam and sail commerce of each Pacific port.

At the close of the year 1898 the traffic of the year 1888 was studied according to the methods that had been de-

veloped, and tables were made comparing the years 1888 and 1898 to show what development had taken place during the decade in the commerce being investigated. The following table abbreviated from one prepared by the New Panama Canal Company shows the steam and sail tonnage of each of the four groups of commerce for the calendar years 1888, 1898, and 1899:—

TONNAGE OF VESSELS ENGAGED IN TRADE BETWEEN THE ATLANTIC AND PACIFIC OCEANS 1888, 1898, 1899

	Group 1. Europe with Pacific America.	Group 2 Europe with the Orient	Group 3. Between Atlantic and Pacific America.	Group 4. Atlantic America with Orient.	Total for the Year.
1888 { Steam	346,015	2,396,105	4,716	78,994	2,825,830
{ Sail	1,744,661	1,659,759	217,597	681,877	4,303,894
Total . .	2,090,676	4,055,864	222,313	760,871	7,129,724
1898 { Steam	648,568	3,669,091	91,082	441,246	4,849,987
{ Sail	1,680,573	948,222	148,204	835,682	3,612,681
Total . .	2,329,141	4,617,313	239,286	1,276,928	8,462,668
1899 { Steam	570,997	4,059,392	94,319	699,913	5,424,621
{ Sail	1,804,074	1,053,862	107,830	571,444	3,537,210
Total . .	2,375,071	5,113,254	202,149	1,271,357	8,961,831

The commerce included in Groups 1, 3, and 4 of the above table is considered as certainly tributary to the proposed American canal. The commerce of Europe with Eastern countries, Group 2, will, for the greater part, make use of the Suez route; but a portion of the traffic will find the American waterway more advantageous. What share of the total for Group 2 may properly be credited to the westerly canal route must be a matter of estimate. A careful review of the existing trade routes, and

a consideration of the forces that will affect the ocean routes after the American canal has been opened, lead to the conclusion that a portion of Europe's exports to the western half of the Pacific Ocean—that is, to Japan, Australia, and Oceania—will be sent through the American canal.

The volume of traffic to Europe from the East being larger than that outbound from Europe, vessels are obliged to sail both for the eastern part of the United States and for Eastern countries lightly loaded, and sometimes in ballast. Our exports from Atlantic ports to Australia, Oceania, and the Orient are in part carried by ships that cross the Atlantic in ballast. When the American canal has become available, vessels will probably not infrequently take on a partial cargo in Europe for countries in the western half of the Pacific, and also take freight for the United States, the West Indies, Central America, or Mexico; that is, vessels finding difficulty in securing cargoes outbound from Europe will sometimes find it advantageous to proceed to the East by way of America, for the purpose of discharging such European-American cargo as may be secured, and loading at one or more American ports a full cargo for the Pacific port or ports of its destination. In addition to permitting vessels in Europe to unite the light outbound cargoes for the East and for the United States and enabling them to secure full cargoes in America for the East, the westerly route by way of the American canal will have the advantage of cheaper coal, and will probably impose lower canal tolls upon the shipping than will be exacted by the Suez Canal. The Suez Canal is, and doubtless will remain, a highway managed by a corporation, whereas the American waterway under consideration is to be owned and operated by the government.

The distance from Liverpool to Sydney, Australia, by

way of the Nicaragua Canal and Tahiti will be only 172 miles greater than via the Suez, Colombo, Adelaide, and Melbourne; and this small disadvantage of the westerly course will be partially, if not quite, offset by two facts favoring the American canal route. From Liverpool via the Cape of Good Hope, Adelaide, and Melbourne, Sydney is 772 miles farther than by way of a Nicaragua canal and Tahiti. The use of the westerly route will enable vessels engaged in the European-Australian trade to avoid the excessive heat of the Gulf of Aden and the Red Sea and the storms of the tempestuous Indian Ocean. The American route also will be favored by the fact that a vessel on its way between Liverpool and the Isthmian Canal will have to go but 323 miles out of its course to call at New York, whence outbound cargoes are practically always obtainable. With the advantages of cheaper coal, a cooler passage in the tropics, quieter seas, and the attractive force of America's heavy tonnage, the American Isthmian route will be used instead of the course through the Suez Canal by some of the vessels departing from Europe for Australia or other regions on that side of the Pacific Ocean.

Vessels proceeding from Europe by way of American ports and the Isthmian Canal to Oceania and the East will have the choice of returning to Europe either by way of the Suez or by way of the American route. By whatever route the European vessels reach the Oriental and other countries of the western Pacific, the route by which they return to Europe will be determined by the relative opportunities for obtaining cargo by way of the Suez and American routes respectively. The reasons for believing that a portion of Europe's imports from the western half of the Pacific will come by way of the American route are stronger than the reasons just cited regarding the use

of the American canal for the European export trade. A vessel finding itself in the East Indies, Japan, China, or Australia, may either take on cargo for Europe and for intermediate ports along the Suez route or it may load with such cargo as may be available for Europe and American countries, and proceed—in most cases but partially loaded—across the Pacific to the western coast of the United States, where a great abundance of cargoes destined for Europe may be obtained, or the ship may go to Central America and West Indian ports, where a fair amount of freight for Europe will usually be available, or the vessel may proceed to Chile or some other west South American country, where there is always a heavy amount of outbound traffic. Besides being certain of securing freight from South America or North America for Europe, a vessel returning from the Orient by the American canal will also have the advantage above referred to of being able to secure coal more cheaply than it can be obtained along the Suez line.

It would seem probable upon *a priori* grounds that vessels leaving Europe, whether by way of the Suez or by way of the American canal, will frequently find the return trip via America more profitable than by the route in the opposite direction. This general proposition, moreover, seems to accord with the evidence regarding the present round-the-world movement of vessels. The entrance and clearance statistics of the vessels engaged in the foreign trade of the west coast of North and South America indicate that a large number of vessels now going out from Europe toward the East return from the west.

TONNAGE OF AVAILABLE CANAL TRAFFIC, 1899.

The records kept by the Panama Company show that during the calendar year 1899 the commerce of Groups

1, 3, and 4 might have contributed 3,848,577 tons net register to the traffic of the Isthmian Canal. This sum does not include any vessel tonnage for the commerce crossing the Isthmus of Panama. The addition of that tonnage, 336,998, raises the total to 4,185,575. The entrances and clearances for the commerce of the eastern seaboard of the United States with Pacific America and with Australia, Oceania, the Philippines, Japan, China, and Siberia, and the vessel movements between the western coasts of the American continents and the North Atlantic American and European ports, were found to amount to 4,074,852 vessel tons net register, including the 336,998 tons for the commerce crossing the Isthmus of Panama.

In addition to this tonnage, which comprises only traffic originating or terminating in America, there should be included most of the commerce of Europe with New Zealand and the other islands of the Pacific east of Australia. New Zealand will be 1,503 miles nearer Liverpool by the Nicaragua Canal than via the Suez route, and 2,407 miles nearer than by way of Good Hope. The distances to Liverpool from the most important groups of South Pacific Islands north of New Zealand will be from 500 to 5,500 miles less via the Isthmian Canal than by way of Suez. The entrances and clearances of New Zealand's trade with north-western Europe—France and countries farther north—amounted to 481,178 tons net register in 1899, and the commerce of that part of Europe with the other islands of the South Pacific east of Australia to 181,743 tons. Of this total traffic of 662,921 tons, not less than 500,000 might have advantageously used an Isthmian Canal, and this amount should be added to the tonnage of the canal traffic originating or terminating in America. This makes the total obtained by the Commission's investigation of the tonnage that might

have used an Isthmian Canal in 1899 4,574,852 tons net register; and the total obtained by adopting the New Panama Canal Company's figures for the traffic originating or terminating in America, 4,685,575 tons.

The above totals for the tonnage that might have used an Isthmian Canal in 1899 do not include any of Europe's trade with Australia and Japan, a part of which would have used an Isthmian waterway. The distances from Great Britain to Sydney and Yokohama by the Suez and Isthmian Canal routes are approximately equal, and vessels going by America in either direction *en route* between Europe and Japan or Australia will pass regions from which there is a heavy export tonnage. If it be assumed that only 10 per cent. of the vessel tonnage of the Australian trade with the ports of North-western Europe and only 5 per cent. of the tonnage of the Japanese commerce with those ports would have taken an American canal route, the totals for 1899 should be increased 316,223 tons, and be raised from 4,574,852 to 4,891,075 tons, and from 4,685,575 to 5,001,798 tons, or to approximately 5,000,000 tons.

COMPARISON OF THE RESULTS OF THE THREE TRAFFIC INVESTIGATIONS.

The three investigations outlined above were made not only without reference to each other, but also according to entirely different methods. Two of the investigations were made by the Isthmian Canal Commission, and the other under the direction of the New Panama Canal Company. It is not often in statistical and economic investigations that such an opportunity for checking up results is afforded as is possible in the present instance. *The freight tonnage* of the trade between Europe and Western America and the tonnage going by water between

the eastern seaboard of the United States and Pacific countries amounted to 6,703,608 tons in 1899. The total entrances and clearances of the vessels engaged in this trade at that time equalled 3,965,540* tons net register. This would make the average ratio of cargo tonnage to net register tonnage 1.69. The records of vessel movements kept by the New Panama Canal Company show a tonnage of 3,646,428 net register tons during the calendar year 1899 for the commerce of Groups 1 and 4, which correspond in general, although not exactly, with the trade included in the above cargo tonnage total. The ratio of cargo tonnage to the vessel tonnage of Groups 1 and 4 is 1.83. This is a somewhat higher ratio than that between the cargo tonnage and vessel tonnage of entrances and clearances.

The tables prepared by the New Panama Canal Company do not include the vessel tonnage of the trade at Panama. Their method of recording the movements of vessels passing from ocean to ocean and totalizing those movements naturally would not take account of the traffic at Panama. In the tonnage total of entrances and clearances obtained by the Isthmian Canal Commission the Panama traffic was reckoned to be 336,998 tons net register. If this sum be added to the vessel tonnage total of Groups 1, 3, and 4, and the cargo tonnage be divided by this larger figure, the ratio becomes 1.60.

The "dead-weight" cargo carrying capacity of American schooners of 500 to 2,000 tons net register averages about 66 per cent. more than the net register; but this ratio varies greatly with different vessels. The ordinary modern freight steamer, when fully loaded, will carry about

*This is 4,074,852 tons minus 109,312 tons, the coasting trade between our two seabords. The 6,703,608 tons of cargo do not include any of our coasting trade: hence the vessel tonnage total is reduced before comparison is made with the total cargo tonnage.

2.25 tons of cargo for each ton net register. Vessels are not fully loaded on all voyages. Some are obliged to make trips in ballast in search of cargo, and many more are but partially laden on the outbound or return voyage of a round trip. There are very few ports of the world where the volume of exports and imports are equal. Great Britain buys a much larger bulk of commodities than she sends out. The opposite is true of the United States and Western South America. Consequently, the average cargoes of ocean vessels engaged in international trade are much less than their maximum carrying capacity.

The ratios of cargo to net register tonnage, obtained above by dividing the total available canal freight tonnage by the corresponding net vessel tonnage, are about what might be expected on *a priori* grounds. The fact that these ratios are apparently correct is not a definite proof of the accuracy of the tonnage totals compared, but it is corroborative evidence. If any one of these three totals compared were grossly in error, there could not be such close correspondence in the ratios.

The total of *entrances and clearances* in the trade of the year 1899 between Europe and Western America, and between the Eastern United States and Pacific countries, 4,074,852 tons, is somewhat less than the New Panama Canal Company's total of vessels engaged in this commerce, if the traffic at Panama be added to their figure for groups 1, 3, and 4. The tonnage of these three groups during the calendar year 1899 was 3,848,577; and this, plus the entrances at Panama in 1898 336,998 tons (the vessel tonnage adopted for the entire Panama traffic), amounts to 4,185,575 tons.

A more detailed comparison of the tonnage figures of tables prepared by the Commission with those made by the New Panama Canal Company would show that the

totals for the two coasts of America are not very different. It is uncertain whether the trade of Hawaii is included in Group 3 of the Panama Company's tonnage table. If it is, the Commission's figures are larger: if Hawaii is not comprised in Group 3, its inclusion there would make the Panama Company's figures greater. For the trade between Europe and the west coast of the Americas the Commission's total is somewhat larger than the Panama Company's, 178,967 tons, if the trade of Hawaii be included in the Commission's figures, and 153,935 tons, if omitted. If Group 3 does not include the Hawaiian commerce, the vessel tonnage of that commerce should be subtracted from the figures of "entrances and clearances" before the comparison is made. Concerning this difference of 154,000 or 179,000 tons between totals approximating two and a half millions, it should be said that the periods covered by the two totals are not identical, and that the two methods of determining vessel movements could hardly be expected to yield exactly the same results. Vessels do not always make the port they clear for. Accidents may prevent or telegraphic orders from the owner or charterer may change the course of the vessel.

It is in the vessel tonnage of the commerce between the Eastern American seaboard and the countries of the western part of the Pacific (*i.e.*, the Far East) that the largest difference exists between figures of the Panama Company and the Commission. The total of Group 4 in the calendar year 1899 was 1,271,357, while the total of entrances and clearances accepted for the fiscal year ending June 30, 1899, by the Commission for the trade between the eastern seaboard of the United States and the western Pacific countries was 908,140 tons net register. This amount, it will be recalled, is twice the tonnage of vessels clearing direct from the Atlantic seaboard to Japan,

Siberia, China, the Philippines, and Australasia. Group 4 of the French tables includes some commerce (that of Singapore and the Dutch East Indies) not comprised in the Commission's figures for the trade between our eastern seaboard and trans-Pacific countries. Moreover, a complete statement of the vessel tonnage of this commerce cannot be made from our statistics of entrances and clearances, because a share not only of the commodity traffic, but also of the vessel tonnage of this commerce, is credited in our statistical records to our trade with Europe. It is quite possible that the vessel tonnage engaged in the commerce between our eastern seaboard and the countries of the western Pacific is somewhat greater than 908,140 tons net register. Group 4 applies to the commerce between the entire east coast of the American continent and the countries of the western Pacific; but there can be but very little vessel movement between the Far East and any Atlantic American countries other than the United States.

The only other tonnage item requiring mention in this comparison is that of the commerce at the city of Panama referred to above. The total of entrances and clearances, as determined by the Commission, credit that traffic with 336,998 vessel tons net register, whereas the methods in accordance with which the calculations of the New Panama Canal Company were made were such as not to include that tonnage.

The results of the three traffic investigations are such as to affirm the essential accuracy of each. The ratio between cargo tonnage and vessel tonnage apparently accords with the facts of ocean commerce. In view of the complexity of the statistical problem and the difference in the methods of dealing with the problem and the slight difference in periods covered, the vessel tonnage totals

obtained by the Commission's investigation of entrances and clearances and the New Panama Company's record of vessel movements correspond as closely as could be expected.

GROWTH OF TRAFFIC, 1899-1914.

The factors affecting the growth of commerce are so numerous and so interrelated that it is difficult to estimate the growth in traffic that will take place during the decade or more that must intervene before an Isthmian Canal can be ready for use. The only basis of calculation is the increase of the past under the conditions of production and transportation and the requirements of international trade that then prevailed. All of these conditions are constantly changing, and thereby affecting the volume and nature of the commodities exchanged and the routes followed by the commerce of the world.

Of one thing, however, there can hardly be any uncertainty. Commercial progress during the near future will be fully as rapid as it has been the past ten or twenty years. The demands of consumers are everywhere expanding; and sections like Africa and Eastern Asia, that have thus far had but slight contact with the rest of the world, are being rapidly brought within the sphere of international commerce. The costs of transportation, both inland and maritime, continue to decline with the improvement of mechanical appliances and the accumulation of capital seeking profitable investment. Nations and individuals are devoting themselves with energy to the extension of trade and commerce. This is particularly true of the people and government of the United States.

Such being the case, the probable tonnage of the traffic that will be available for an Isthmian Canal at the time

of its completion will doubtless be conservatively estimated by predicating a continuation of the rate of increase that has prevailed during the past decade. In all probability the growth will be more rapid in the future: it surely will not be slower.

The statistics of the New Panama Canal Company found that the tonnage of the vessels trafficking between the two coasts of America, between the Eastern United States and the Orient, between Europe and Pacific America,—*i.e.*, the available canal tonnage originating or terminating in America,—increased from 3,073,860 tons net register in 1886 to 3,845,355 tons in 1898,—a gain of 25.1 per cent. To determine whether this rate of increase per decade was one whose use would result in a conservative estimate of the probable available canal traffic in 1914, a study was made of the progress in the vessel tonnage and value of the international trade of several typical regions. It was found that the value of the trade between the Atlantic coast of the United States and Pacific South America increased 26.8 per cent. during the decade 1889-99. For the commerce between our Atlantic seaboard and Pacific countries other than South America the growth was 49.7 per cent. The trade of the United States with Australasia more than doubled during the decade ending in 1900. The vessel movements between Europe and Chile increased 33.3 per cent. during the ten years ending in 1898. European entrances from the west coast of South America gained 36.5 per cent. While the trade between the Pacific Coast of the United States and trans-Pacific countries will not use the canal, the rate at which that commerce is increasing may well be considered in this connection. The total entrances and clearances of the trade between our Pacific Coast and Hawaii, Siberia, Japan, China, and Hongkong gained 191 per cent. from 1889 to 1899.

In view of these facts it would seem that an increase of 25.1 per cent. per decade up to the time of the opening of the canal may be very safely and conservatively predicated concerning the traffic that might have advantageously used the waterway in 1899. Predictions concerning the coming ten or fifteen years must necessarily be based upon the experience of the past; and, unless the decade upon which the calculations here presented as to the future are made to rest was one of abnormally rapid or slow commercial progress, it may properly be made the basis. Taken as a whole, the decade preceding 1899 was probably one during which the world made normal industrial and commercial progress. In the United States the earlier years and the last year of the period were characterized by great business activity, but during fully a third of the decade a business depression of unusual severity prevailed. The years from 1893 to 1897 were more trying ones in this country than they were in Europe, but business was dull rather than active in Europe during that time. Consequently, it is probable that estimates based upon this decade will not lead to an exaggeration of the facts.

The Panama Canal Company's figures for the vessel movements of the commerce originating or terminating in America, increased by the present trans-Isthmian traffic, and 816,223 tons of Europe's trade with Oceania, Australia, and Japan, show that the available canal traffic for the calendar year 1899 was 5,001,798 tons net register. An increase of 25.1 per cent. during the decade ending in 1909 would raise the amount to 6,257,249 tons; and the same rate of growth would bring the total to 6,998,733—or, in round numbers, 7,000,000—tons in 1914.

If the tonnage of available canal traffic in 1899, as determined by the Isthmian Canal Commission's study of entrances and clearances, be made the basis of estimate,

and the increase of 25.1 per cent. per decade be assumed, the figures for 1909 will be 6,118,735 net register tons, and for 1914 6,843,805 tons.

In the foregoing estimates of tonnage the figures refer to the available canal traffic. It is not probable that all of the commerce included in the above totals will at once abandon the routes at present followed, and immediately make use of the Isthmian waterway. It will take some time to readjust trade with reference to the new conditions which the canal will establish, and possibly two years may be required for merchants and carriers to adapt themselves to all the changes in the routes and methods of international trade that the use of the canal will necessitate. The totals to which the three investigations of available canal tonnage have led may be designated as the measure of all the commerce that would have used the canal in 1899, had the commerce of our own and foreign countries been adjusted to the condition of trade which the canal would have established. There is no tonnage included in the totals which might not advantageously use the canal, except during the temporary period of transition from the existing conditions governing international trade and controlling the commerce between our eastern and western seaboard, to those conditions which will exist after the Isthmian route has been opened.

ESTIMATE OF GROWTH OF TRAFFIC DURING FIRST DECADE OF THE USE OF THE CANAL.

The new interoceanic communication will so greatly modify the routes of commerce, and the conditions controlling the progress of the industries and commerce of many sections of the world, that the problem of estimating the increase that may be expected to take place in the

tonnage using the canal during the first decade following the opening of the waterway is a different one from that of predicting the growth of available traffic up to the time of the completion of the canal. The rate of increase will be much more rapid after the canal has been put into service and its economic effects have begun to be realized.

While it is not to be expected that the traffic of the Isthmian waterway, during the early years of its operation, will increase so rapidly as did the tonnage passing the Suez Canal, the best basis for estimating the probable increase that will occur in the tonnage of the American Isthmian waterway is the rate of growth that the traffic of the Suez Canal has had. The increase in the traffic of the Suez Canal is well shown by grouping the figures into five-year periods, and comparing the totals of these periods. This is done in the following table:—

INCREASE IN THE NUMBER OF VESSELS AND TONNAGE OF THE
SUEZ CANAL BY QUINQUENNIAL PERIODS.

Years	Number of Vessels	Net Tonnage.	Per cent. Increase	Percentage which the ton- nage of each five-year pe- riod is of the tonnage of 1875-1879
1870-74	4,770	5,358,237		
1875-79	7,684	10,995,214	105	
1880-84	14,542	23,916,374	117	217
1885-89	16,726	31,430,454	31	286
1890-94	17,848	39,899,143	27	363
1895-99	16,939	44,042,274	10	401

If the first five-year period were made the basis of comparison, the rate of increase would be so great as to exaggerate the progress which the traffic made during the subsequent quinquennial periods. The Suez Canal could be used advantageously only by steamers, and in 1870 the number of steamers available for the commerce between

Europe and the East Indies was limited. For some years the greater part of the commerce continued to go in sailing vessels around the Cape of Good Hope. After the canal had been in use a few years, however, steamers were to a large extent substituted for the sailing vessels, and the Suez route for the Cape route for the greater part of the business. It will be seen that the traffic of the five years 1880-85 was 217 per cent. that of the previous quinquennial period. The tonnage of 1885-89 was 286 per cent. of the period from 1875 to 1879; the tonnage of 1890 to 1894 was 363 per cent.; and that of 1895 to 1899, 401 per cent. of the traffic of the five years 1875 to 1879. During the last quinquennial period of the twenty-five years from 1875 to 1899 the traffic of the Suez Canal was four times what it was during the first five years. Had the traffic of the years 1870-74 been made the basis of comparison, the above percentages would have been very much larger.

Omitting the first two years when the traffic was comparatively light because but few steamships were available for the trade between Europe and the East, and making 1872 the basis of comparison, it will be seen that the traffic grew from 1,160,743 net tons in 1872 to 5,074,809 net tons in 1882,—a gain of 337 per cent. The tonnage of 1875 had increased 215 per cent. by 1885. The traffic of 1890 was 125 per cent. greater than that of 1880. Since 1890 the absolute gain in the tonnage figures has been large, although the percentage of increase is less than it formerly was. The gain of 46 per cent. from 1889 to 1899 represents an increase of 4,210,247 tons gross register and 3,112,443 tons net.

Should the rate of increase in the tonnage of the Isthmian Canal during the first ten years be half that of the Suez during the second decade of its use, the rate would be $62\frac{1}{2}$ per cent. In view of the much larger rate shown

by the Suez Canal, and in view of the conditions that will favor commercial progress at the time of and subsequent to the opening of the American canal, $62\frac{1}{2}$ per cent. is believed to be a conservative estimate.

A decennial increase of $62\frac{1}{2}$ per cent. in the estimated traffic available for the canal in 1914, as determined by the figures obtained by using the tables prepared by the New Panama Canal Company, would give a tonnage of 11,372,941 net vessel tons in 1924. A $62\frac{1}{2}$ per cent. increase in the estimated vessel tonnage total of 1914 reached by the Commission's study of entrances and clearances—6,843,805—would amount to 11,121,183. These two estimates for 1924 average about 11,250,000 tons.

For reasons stated above the entire amount of the available canal tonnage can hardly be expected to use the new route during the first year or two of the operation of the waterway,—the period required for the readjustment of commercial arrangements. This adjustment will, however, not be delayed by a scarcity of steamers, and will be quickly made. After two years the full amount of the available canal tonnage—the available tonnage of 1916, not of 1914—will in all probability be passing the canal.

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